SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.

1.2 SUMMARY

A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for structural steel as required for the complete performance of the work, and as shown on the drawings and as herein specified.

B. Section Includes: Provide structural steel and related items as shown on the drawings and specified herein. Furnish anchor bolts as required.

C. Related Sections: The following sections contain requirements that relate to this section:
1. Division 3 Section “Cast-In-Place Concrete”
2. Division 4 Section “Unit Masonry”
3. Division 5 Section “Steel Deck”
4. Division 7 Section “Sprayed On Fireproofing”
5. Division 9 Section “Painting”

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

C. American Institute of Steel Construction, Inc. (AISC):
1. AISC MSC "Manual of Steel Construction ASD".
2. AISC CSP "Code of Standard Practice for Steel Buildings and Bridges".
3. AISC QCP "Quality Certification Program".
4. AISC SSJ "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
5. AISC SSSB "Specification for Structural Steel Buildings".
6. ANSI/AISC N690-1994 “American National Standard Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities” (Target Building only)

D. American Welding Society (AWS):
1. AWS D1.1 "Structural Welding Code - Steel"

E. ASTM (ASTM):
1. ASTM A 6 "Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
2. ASTM A 36 "Standard Specification for Structural Steel".
3. ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless".

4. ASTM A 108 "Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality".
5. ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products".
6. ASTM A 153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware".
7. ASTM A 307 "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength".
8. ASTM A 325 "Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength".
9. ASTM A 490 "Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength".
10. ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes".
11. ASTM A 572 "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality". Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997.
12. ASTM A 501 "Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing".
13. ASTM A992 ""Standard Specification for Steel for Structural Shapes for use in Building Framing".
14. ASTM B 695 "Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel".
15. ASTM E 94 "Standard Guide for Radiographic Testing".
16. ASTM E 142 "Standard Method for Controlling Quality of Radiographic Testing".
17. ASTM E 164 "Standard Practice for Ultrasonic Contact Examination of Weldments".
18. ASTM E 165 "Standard Practice for Liquid Penetrant Inspection Method".
19. ASTM E 709 "Practice for Magnetic Particle Examination".
20. ASTM E 736 “Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Steel”
21. ASTM F 568 "Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners".

F. Corps of Engineers, U.S. Army (CE):
1. CE CRD-C-621 "Corps of Engineers Specification for Non-shrink Grout".

G. Military Standardization Documents (MIL):
1. MIL-P-21035 "Paint, High Zinc Dust Content, Galvanizing Repair".

H. Steel Structures Painting Council (SSPC):
1. SSPC SP-6 "Surface Preparation Specification No. 6, Commercial Blast Cleaning".
2. SSPC SP-7 "Surface Preparation Specification No. 7, Brush-Off Blast Cleaning".

1.4 SUBMITTALS

A. General: Submit the following in accordance with provisions of the Contract, including General and Supplementary Conditions.

B. Product Data: Submit product data including, but not limited to, manufacturer's specifications, technical product data, installation instructions, catalogue cuts, and other information necessary to show compliance with requirements. Products for which product data is required shall include, but shall not be limited to, the following:
1. Shear connectors.
2. Primer paint.
3. Grout.

4. Load indicator type bolts with twist-off splined end.

C. Shop Drawings: Submit shop drawings showing shop and erection details. Shop drawings shall include complete information necessary for the fabrication of the component parts of the structure, including, but not limited to, the location, type, and size of bolts and welds. Welds shall be indicated by standard welding symbols of the AWS. Show size, length, and type of each weld. Connections for any portion of the structure not shown on the drawings shall be designed and detailed by the fabricator and indicated on the shop drawings.
   1. The Construction Manager's review of shop drawings will be for general arrangement and details of design, but not to figured dimensions or construction details. Compliance with requirements for materials, fabrication, and erection of structural steel shall be the Contractor's responsibility.
   2. Details shown are typical. Similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

D. Templates and Setting Drawings: Furnish setting drawings, templates, and directions for the installation of anchor bolts and other anchorages for installation under other sections.

E. Design Data: Submit calculations for review prior to preparation of shop drawings. Furnish structural calculations with connection detail drawings for each connection type, member size, and reaction indicated on the drawings. Calculations shall be clearly cross referenced to drawing locations and shop drawing marks. The calculations shall be prepared and sealed by a professional engineer or structural engineer licensed in the State of Tennessee. The details shown on the drawings are conceptual only and do not indicate the required number of bolts or required weld sizes, unless specifically noted. Connections for Target Building shall be designed in accordance with ANSI/AISC N690.

F. Mill Test Reports: Submit copies of certified mill test reports, including, but not limited to, names and locations of mills and shops, covering the chemical and physical properties to show compliance with these specifications (including specified standards). Submit mill test reports for the following:
   1. Structural steel.
   2. High strength bolts (each type) including nuts and washers.
   3. Anchor bolts.

G. Certification of Fabricators: Submit copies of certifications indicating that the fabricator and each plant have been certified in Category II of the AISC QCP.

H. Certification of Welds and Welders: Submit copies of welder qualification records (WQR) from a qualified testing agency indicating that each welder is qualified in accordance with AWS D1.1 for the types of welding necessary for this Project. Submit copies of each welding procedure necessary for this Project indicating the procedure has been pre-qualified in accordance with AWS D1.1.

I. Control of Welding Materials for Target Building: Fabricator, erector and material supplier shall submit procedures used to control the purchase, receipt, storage, handling and use of electrodes, flux and other welding material to be used in the welding process.

J. Surveys: Submit scaled plans of survey data required in Part 3 - Execution.

K. Statement of Manufacturer's Review: Submit statement of manufacturer's review, signed by the Contractor, the Installer, and the manufacturer, stating that the drawings and

specifications, shop drawings, and product data have been reviewed by the manufacturer, and that they are in agreement that the selected materials and systems are proper and adequate for the application shown including, but not limited to, compatibility with adjacent materials and systems. Products for which manufacturer's review is required shall include, but shall not be limited to, the following:

1. Shear stud connectors.
2. Primer paint.
3. Non shrink grout.
4. Load indicator type bolts with twist-off splined end.

1.5 QUALITY ASSURANCE

A. Fabricator Certification: The structural steel fabricator and the plants where structural steel is fabricated shall be certified in Category II of the AISC QCP.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Codes and Standards: The following publications form a part of this specification to the extent indicated by the references thereto:

1. AISC MSC.
2. AISC CSP.
    a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence:
        1) “This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as part of his preparation of these shop drawings."
3. AISC SSJ.
4. AISC SSSB.
5. AWS D1.1.
6. ASTM A 6.
7. ANSI/AISC N-690 for Target Building

D. Manufacturer's Representative: At the start of installation furnish the services of the manufacturer's technical representative at the job site to advise on the installation of load indicator type bolts with twist-off splined. Furnish full-time attendance during the first two work days and furnish technical assistance as may be required as work progresses.

E. Pre-Construction Conference: Conduct conference at project site to comply with requirements of General Conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Conform to the requirements of ASTM A 6. Deliver materials to the site at such intervals as shall avoid delay in the work. Deliver anchor bolts and anchorage devices for embedment in cast-in-place concrete in ample time to avoid delay in that work. Include setting diagrams.

B. Storage: Store material in a clean, properly drained location. Keep material off the ground. Use pallets, platforms, or other proper supports. Prevent distortion, corrosion, and other damage.

1. Do not store materials on the structure in a manner that might cause distortion or damage to the supporting structure. Repair or replace damaged material in an approved manner without additional cost to the Owner.

C. Handling: Handle material safely and in a manner that shall prevent distortion or other damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Angles, M- Shapes, S- Shapes, Channels, Plates, and Bars: Comply with ASTM A 36, unless otherwise indicated on the drawings.

B. Structural Steel W- Shapes: Comply with ASTM A 572, Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997 or with ASTM A 992, Grade 50.

C. Cold-Formed Steel Tubing: Comply with ASTM A 500, Grade B, Fy of 46 ksi.

D. Hot-Formed Steel Tubing: Comply with ASTM A 501, Fy of 36 ksi.

E. Steel Pipe: Comply with ASTM A 53, Type E or Type S, Grade B; or ASTM A 501.
1. Finish: Black, except where indicated to be galvanized.

F. Headed Stud-Type Shear Connectors: Comply with ASTM A 108, Grade 1015 or Grade 1020, cold-finished carbon steel, AWS D1.1, Type B.

G. Anchor Bolts as follows with hexagonal nuts and heavy washers. Material is shown on drawings.
1. ASTM A 36.
2. ASTM A 307.
3. ASTM A 572, Grade 50.

H. High Strength Threaded Fasteners: Provide heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325. Load indicator type bolt with twist-off splined end.
2. Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A 490. Load indicator type bolt with twist-off splined end.
3. Where indicated as galvanized, provide units that are zinc-coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.

I. Non-high Strength Bolts, Nuts and Washers: ASTM A 307, Grade A, carbon steel, hex head bolts: carbon steel nuts, and flat, unhardened steel washers.

J. Electrodes for Welding: Comply with AWS code.

K. Structural Steel Primer Paint:
1. Interior:
a. Structural Steel: Two component high build epoxy system. Color to be selected by Construction Manager.
b. Structural Steel Special Color: Refer to architectural drawings for steel members to be primed and painted in accordance with Section 09900, Painting. This applies to steel members, such as crane runways; channels at edge of

mezzanines, walkways and equipment platforms; steel columns which support the mezzanines; stair stringers; and handrails and guardrails.

2. Exterior: Refer to Section 09900, Painting.

L. Nonmetallic Shrinkage-Resistant Grout: Provide premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30 minute working time.

2.2 FABRICATION

A. General: Fabrication shall be in accordance with the applicable provisions of AISC SSSB. Fabricate for delivery sequence which shall expedite erection and minimize field handling. Fabrication and assembly shall be done in the shop to the greatest extent possible. Workmanship shall be equal to standard commercial practice in modern structural shops. For the fabrication of items which shall be exposed to view, use only materials which are smooth and free of surface blemishes including, but not limited to, pitting, seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes including zinc coatings. Provide camber in structural members where indicated. Fabricate members with natural camber up.

B. Holes:
1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.
2. Provide holes required for securing other work to structural steel framing and for the passage of other work through steel framing members as indicated. Provide threaded nuts welded to framing and other specialty items as shown to receive other work as part of structural steel work.

C. Welded Construction: Comply with AWS code for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Weld procedures shall be pre-qualified welds in accordance with AWS D1.1 or Attachment A.
2. Assemble and weld built-up sections by methods that shall produce true alignment of axes without warp.
3. After welding is complete, welds shall be thoroughly cleaned.

D. Weeps: Fabricate joints which shall be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

E. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized as follows:
1. Comply with ASTM A 123 for galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strips 1/8 inch (3 mm) thick and heavier and for galvanizing assembled steel products.
2. Zinc coatings that have been damaged in handling or transporting or in welding or bolting shall be repaired by the application of a galvanizing repair paint conforming to MIL-P-21035. Areas to be repaired shall be cleaned and the slag removed from the welds. Surfaces to which the repair paint is applied shall not be heated.

F. Shop Painting:
1. Provide shop-applied paint system. Except as otherwise shown or specified, structural steel work shall be shop painted. Refer to paragraph 2.1.K for structural steel to be painted in accordance with Section 09900, Painting.

2. Surfaces not to be painted shall include, but shall not be limited to, the following:
   a. Zinc-coated surfaces.
   b. Surfaces to be field welded, within 3 inches (76 mm) of the weld.
   c. Contact surfaces of slip critical connections.
   d. Surfaces of steel to be embedded in concrete.
   e. Surfaces to receive sprayed on fireproofing.
3. After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with SSPC specification or as follows:
   a. For Interior and Enclosed Exterior Structural Steel: SSPC SP – 6, Commercial Blast Cleaning
   b. For Exterior Exposed Structural Steel: SSPC SP- 6, Commercial Blast Cleaning
4. No painting shall be done in freezing or wet weather except under cover, the temperature shall be above 45 °F (7 °F) but not over 90 °F (32 °F). Surfaces shall be thoroughly dry and clean when the paint is applied. Primer application shall follow immediately after surface preparation, except treated surfaces shall be primed as soon as practicable after the pretreatment has dried. Brush or spray on epoxy metal primer paint, applied in accordance with the manufacturer's instruction and at a rate to provide a minimum uniform dry film thickness of 4.0 mils. Use painting methods which shall result in full coverage of joints, corners, edge, and exposed surfaces. Repair damage to primed surfaces with primer.
5. Follow manufacturer’s recommendations or limitations if relative humidity measurements are in excess of 40% in areas where painting is to occur.
6. Paint type shall be suitable for use intended.
7. Apply one shop coat of metal epoxy primer paint to fabricated metal items.

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.3 SOURCE QUALITY CONTROL

A. General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests shall not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
   1. Promptly remove and replace materials or fabricated components that do not comply.

B. Design of Members and Connections: Details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
   1. Promptly notify the Construction Managerr whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Construction Manager, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 ERECTION

A. General: Except as modified herein, erection shall be in accordance with AISC CSP and AISC SSSB.

B. Adjustments: Set structural frames accurately to the lines and elevations indicated. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Level and plumb individual members of the structure within specified AISC tolerances. Maintain written records of the measurements and corrections. Submit copies of these records to the Construction Manager.

C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Anchor bolts and other embedded steel shall be installed under Division 3 Section “Cast In Place Concrete”.

D. Base Plates and Bearing Plates:

1. Base plates and bearing plates shall be leveled using setting plates or leveling nuts or steel shims.
2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims.
3. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned. Fill solidly between bearing surfaces and bases with non-shrink grout, so that no voids remain. Protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions.

E. Welding: Comply with AWS code for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Weld procedures shall be pre-qualified welds in accordance with AWS D1.1 or Attachment A.
2. After welding is completed, welds shall be thoroughly cleaned.

F. Bolt Tightening: High strength bolts shall be fully pretensioned, unless indicated as snug tightened.

1. When calibrated wrenches are used for tightening of bolts, they shall be calibrated at least once each working day, using not less than three typical bolts of each diameter. Tightening torques for high strength bolts shall be in strict accordance with AISC SSJ.
2. When load indicator type bolts with twist-off splined end are used, the condition of the fastening assembly and the installation shall be in strict accordance with the manufacturer's recommendations.

G. Cleaning: Clean surfaces which shall be in permanent contact before assembly. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surfaces of base plates.

H. Connections:

1. Combinations of bolts and welds in the same connections are not permitted, unless otherwise detailed. Connections shall conform to the requirements of AISC MSC. Connections for Target Building shall be designed in accordance with ANSI/AISC N690. Bolted connections shall be detailed with 3/4 inch diameter, ASTM A325, Type N bolts, unless noted otherwise. Bolts shall be load indicatior type with twist-off

spline. Bolted connections for X-bracing and moment frames shall be detailed with 3/4 inch diameter, ASTM A325, Type SC bolts and fully pretensioned. Bolts shall be load indicatior type with twist-off spline.

2. Where connections are indicated on the drawings, no deviation from the type and method thereof shall be made without the acceptance of the Construction Manager. Single-angle, one-sided, or other type of eccentric connections shall not be permitted where two-sided connections can be used. Connections shall be in accordance with submitted calculations.
3. Except where otherwise shown or acceptable to the Construction Manager, field connections shall be bolted where ever possible. Shop connections may be welded or bolted.
4. Unless otherwise indicated on the drawings, non composite beam connections shall be designed to support half of the total allowable load shown in the Table for Allowable Loads on Beams of AISC MSC, for the shape, span, and type of steel specified.
5. Unless otherwise indicated on the drawings, composite beam connections shall be designed to support 80% of the total load shown in the Table for Allowable Loads on Beams of AISC MSC for the shape, span, and type of steel specified.
6. Provide a connection at each end and at each intermediate support of each member unless otherwise acceptable to the Construction Manager.

I. Corrections: Correct deficiencies in structural steel work which inspectors and laboratory test reports have indicated to be not in compliance with requirements. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, such condition shall be reported immediately to the Construction Manager and review of the method of correction obtained. The correction shall be made in his presence. The straightening of plates and angles or other shapes shall be done by approved methods. If heating of metal is approved for straightening, it shall not be to a higher temperature than that producing a dark cherry red color. After heating, the metal shall be cooled as slowly as possible. There shall be no evidence of fracture on the surface of the metal after straightening.

J. Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting shall be permitted only on secondary members which are not under stress, as acceptable to the Construction Manager. Finish gas cut sections equal to a sheared appearance.

K. Equipment: Erecting equipment shall be suitable for the work and shall be in first class condition.

L. Holes: Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

M. Match-Marking: Structural members and component parts shall be assembled and match-marked prior to erection.

N. Surveys: Employ a licensed land surveyor to establish permanent benchmarks as shown and as necessary for the accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to the Construction Manager. Do not proceed with erection until corrections have been made, or until compensating adjustments to the structural steel work have been agreed upon.

O. Splicing: Splice members only where shown or specified.

P. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.

Q. Temporary Welds and Backing Strips: Temporary welds and backing strips need not be removed, unless exposed to view, conflicting with work to follow, or otherwise indicated.
1. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

R. Tolerances: Erection tolerances shall be in accordance with AISC CSP.

S. Touch-Up Field Painting: After erection, field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat. Apply by brush to provide a minimum dry film thickness of 4.0 mils for epoxy paint. For other paint systems, refer to Section 09900, Painting. The cleaning, pretreatment, and priming of welds and the areas adjacent thereto shall be done promptly after the acceptance of the weld and shall be as specified under shop painting.

3.3 QUALITY CONTROL

A. General: The Contractor shall engage an independent Inspection and Testing Agency to perform shop and field inspections and tests specified herein, and prepare test reports. The extent and description of field test requirements shall be as specified hereinafter.

B. Access: Provide access for the Inspection and Testing Agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

C. Reports: The Inspection and Testing Agency shall conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviation therefrom.

D. Bolted Connections: Inspect in accordance with AISC specifications.

E. Qualification of Welders: Qualification of welders shall be the responsibility of the Contractor. Welding shall be performed by qualified welders. The qualification of welders and the duration of qualification period shall be in accordance with the requirements of AWS D1.1. Any welder found to be producing unsatisfactory work even through he has passed qualification tests shall be immediately recertified or replaced with a qualified welder.

F. Visual Inspection of Welds: Visual inspection of welding may be made while the operators are making the welds and again after the work is completed. After the welding is completed, welds shall be hand or power wire brushed and thoroughly cleaned before the inspector makes the check inspection. Welds may be inspected with magnifiers under strong, adequate light for surface cracking, porosity, slag inclusions, excessive roughness, unfilled craters, gas pockets, undercuts, overlaps, size, and insufficient throat and concavity.

G. Nondestructive Testing of Welds: Welds connecting structural steel members shall be tested in accordance with the weld quality and standards of acceptance of AWS D1.1, or ANSI/AISC N690 for the Target Building, using one or more of the following methods:
1. Ultrasonic method inspection of welds, in accordance with ASTM E 164.
2. Magnetic particle inspection methods, in accordance with ASTM E 709.
3. Liquid penetrant inspection methods, in accordance with ASTM E 165.

4. Radiographic testing methods, in accordance with ASTM E 94 and ASTM E 142.

H. Facilities: The Contractor shall furnish facilities for performing the radiography if required including, but not limited to, power and utilities at no additional cost to the Owner.

I. Test Locations: Test locations shall be as selected by the Inspection and Testing Agency in agreement with the Construction Manager.

J. The Testing Agency shall examine a minimum of shop and field work as specified below.
1. 100% of each type of weld shall be visually inspected.
2. 10% of welds shall be measured at random to verify length and/or spacing.
3. Fillet Welds:
   a. 5% of continuity plate fillet welds shall be inspected by magnetic particle for final pass only.
4. Penetration Welds:
   a. 5% of complete penetration welds shall be ultrasonically inspected.
   b. 10% of complete penetration welds shall be ultrasonically inspected for Target Building
   c. 5% of column splice partial penetration welds shall be ultrasonically inspected.
   d. 10% of column splice partial penetration welds shall be ultrasonically inspected for Target Building
   e. 5% of continuity plate penetration welds shall be ultrasonically inspected.
   f. 10% of continuity plate penetration welds shall be ultrasonically inspected for Target Building.
5. 5% of A325 and A490 bolts for “x’ braced frames and moment frames shall be inspected by calibrated torque wrench.
6. Shear Studs:
   a. 10% of shear studs shall be visually inspected to confirm that a continuous 360 degree flash is present.
   b. 10% of shear studs at random shall also be tested by hammering against the side, bending it 15 degrees off perpendicular to beam.
   c. Studs shall also be visually inspected for placement/spacing on the beam according to stud layout shop drawings.

K. Acceptance Standards: Acceptance standards for all weld examinations shall be in accordance with AWS D1.1 or ANSI/AISC N690 for the Target Building.

L. Restesting: The Contractor's Inspection and Testing Agency shall perform such additional tests as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work in accordance with AWS D1.1 or ANSI/AISC N690 for the Target Building. .

ATTACHMENT A

INSPECTION REQUIREMENTS FOR STRUCTURAL WELDS

WELD PLANNING DATA			INSPECTION REQUIRED				REMARKS
Specification or Drawing No.	WPS	Spot Check	Spot Inspection	VT-F 100%	N/A	N/A	
05120 Structural Steel	SM11-1(ST), FC11-1(ST), FC11-2(ST), GM11-1(ST	Req'd.	Req'd.	Req'd.			

Structural WPSs are included in Section 18250

VT-F = Final Visual
Spot Check = Spot observation of welding activities for compliance with the specification by a person designated by the welder's employer other than the welder.
Spot Inspection = Oversight to verify conformance to the welding program. Include at least 5% of functions not included in the required examinations.

END OF SECTION 05120